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## New Species of Mosquitoes from Taiwan (Diptera: Culicidae)\*

Part III. Five New Species of *Aedes*

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**Abstract**

The present paper deals with the description of the larvae, pupae, males and females, of five new species of the mosquitoes belonging to genus *Aedes*. These mosquitoes are named *Aedes (Cancraëdes) penghuensis*, n. sp., *Aedes (Finlaya) loi*, n. sp., *Aedes (Finlaya) chungi*, n. sp., *Aedes (Finlaya) watteni*, n. sp., and *Aedes (Finlaya) omorii*, n. sp. The first was found in the main island of Penghu (Formerly known as the Pescadores or Hokoto) of Taiwan Straits, and the remaining four species on Taiwan Proper. Two of these four species of subgenus *Finlaya* are the members of *Aedes niveus* subgroup. Following the morphological descriptions, the distribution, biology, and systematics of the species are discussed.

This is the third of the series of papers dealing with new species of mosquitoes found on Taiwan Proper and its adjacent islands. Part I of this series describes two new species of *Aedes (Finlaya)*, and Part II five new species of genera *Tripteroides*, *Orthopodomyia*, *Culiseta* and *Uranotaenia*. The present paper deals with the description of five new species of the

mosquitoes belonging to genus *Aedes*. One of the five is a new member of subgenus *Cancraëdes* and the other four are new members of subgenus *Finlaya*. One of these four species of subgenus *Finlaya* falls in the subgroup XI (*fengi*) of group F (*alboannulatus*-group : *Danielsia*), the second in the subgroup V (*unicinctus*) of group B (*terrens*-group : *Gualteria*), and

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\*\* Special Contribution

the remaining two in the subgroup I (*niveus*) of group H (*geniculatus*-group : *Protomacleaya*) of Knight and Marks (1952). Although there are four members of *Aedes niveus* subgroup known to occur in Taiwan, one, *Aedes sinensis* Chow (1950), has not been found by the author. The terminalia of *Aedes albolateralis*, a

mosquito very widely distributed and commonly encountered in Taiwan Proper, is also illustrated for comparison with the two new members of the subgroup. Terminology follows that used in Part II. The following are the descriptions of the five new species.

*AEDES (CANCRAEDES) PENGHUENSIS* LIEN, N. SP.

MALE. *Head*. Antenna slender, with sparse bristles and pubescence; flagellar bristles long; apical segment of antenna about twice as long as subapical segment; the subapical segment about three times as long as each of the remaining segments which are all subequal in length; torus, clypeus, palpus and proboscis all dark brown; palpus very short, about one-eighth the length of proboscis; proboscis rather long, slightly longer than the forefemur (1.1 times). Vertex entirely covered with dark brown broad flat scales; no pale scales and no upright forked scales present. *Thorax*. *Apn* brown anteriorly and pale posteriorly, not scaled, with well-developed dark brown bristles; *ppn* with narrow dark brown scales on dorsal margin and three dark brown bristles dorsoposteriorly; integument pale on lower half and brown on upper half; paratergite with pale brown translucent broad scales; a patch of broad pale brown translucent scales on upper part of sternopleuron, far below pre-alar knob, some scattered similar scales on lower part of sternopleuron, the remaining parts of pleuron without scales; no spiracular bristles; bristles present on propleuron, postspiracular area, pre-alar knob, posterior margin of sternopleuron, upper and

lower parts of mesepimeron and all coxae; upper two-thirds of pleuron pale brown, the remaining lower one-third pale yellow. Mesonotal integument brown; mesonotum covered with dark brown hair-like narrow scales; dorsocentral and supra-alar bristles present, well developed; scutellum with dark brown broad flat scales on all lobes; bristles on posterior margins of scutellar lobes well developed; postnotum brown, bare; wings dark-scaled, scales narrow; sixth wing vein reaching wing margin only slightly beyond base of fork of vein 5; bases of anterior and posterior cells almost at the same level; anterior cell about 1.6 times the length of its stem; posterior cell about 1.3 times the length of its stem. Haltere knob dark. Alula with moderately broad dark brown scales near the margin; squama fringed with pale brown slender bristles. Legs all dark brown except mid- and hind-femora which are pale brown posteriorly and underneath respectively. *Abdomen*. Entirely dark brown dorsally and pale brown ventrally. *Terminalia* (Fig. 1, f, g). Very distinctive; clasper very small bearing a seta; subapical lobes of side-piece with five elongate processes, the more tergal one largest, bearing three darkened roundish teeth on its apex, the

three sternal ones each bearing a darkened more or less elongate tooth at their apices, the remaining one more or less leaf-like, curved at tip. Ninth sternite large, with five setae medially. Proctiger fairly large. Phallosome divided apically, bearing four denticles at each side.

**FEMALE.** Agreeing with male in general coloration. Antenna with sparse flagellar bristles and pubescens, flagellar bristles shorter than those of male; all antennal segments subequal in length; palpus about one-sixth (0.57) the length of proboscis. *Terminalia* (Fig. 1, a-e). Spermatheca single; post-atrial plate very distinctive, membraneous, roundish, with two slightly curved lateral arms, and crease on a broad median area. Ninth tergite very deeply indented apically, forming two lobes, each bearing a few setae.

**PUPA** (as Fig. 3, g, h).

**LARVA** (Fig. 3, a-f). *Head.* Antenna sparsely spiculate, with a hair tuft 1-A of four plumose branches at about middle; hair 1-C single, slightly curved inward; 7-C with 11-12 plumose branches, about one-half the length of antenna; 6-C with two plumose branches, slightly longer than antenna; 5-C with three plumose branches, about as long as 6-C; 4-C with 4-6 slender branches. *Thorax.* Prothoracic hairs 1-3-P all slender; 1-P bifid; 2,3-P both single; 4-P bifid; 5-7-P long, subequal; 5,6-P single; 7-P bifid; 8-P fairly short, with 6-9 branches. *Abdomen.* Segment VIII with a comb of about 100 or more apically fringed scales arranged in a triangular patch; hair 1-VIII with 4-5 plumose branches, 2, 4-VIII both single; 3-VIII with four plumose branches;

5-VIII with 5-6 plumose branches. Anal segment dorsally sclerotized, the sclerotized part occupying about one-third of the segment; hair 1-X single; 2-X 6-7-branched; 3-X single; 4-X consisting of ten hairs, each with 6-10 branches. Siphon with acus; pecten of 7-11 teeth, each tooth with 2-4 lateral denticles; hair 1-S with 3-5 slender branches at about three-fifths from base.

**TYPE SPECIMENS.** Holotype, male (61997.15) with larval and pupal skins, *ex* crab-holes under a bridge near coast, Kunpei, Huhsi Penghu Hsien, Taiwan, July 4, 1961, C. L. Chung; allotype, female (61997.25) with larval and pupal skins, same data as for holotype; paratypes, ten males (61997.1, .2, .3, .8, .9, .11, .12, .16, .17, .18) and 16 females (61997.4, .5, .6, .7, .10, .13, .14, .19, .20, .21, .22, .23, .24, .26, .27, .28), with corresponding larval and pupal skins, same data as for holotype. The specimens are in the collection of Taiwan Provincial Malaria Research Institute, Nankang, Taipei Hsien, Taiwan.

**DISTRIBUTION.** Known also from several localities along the southwestern coast of Taiwan Proper.

**BIOLOGY.** The larva breeds exclusively in crab-holes. Positive collections were made in the same locality in Penghu in July 1959, June 1960, and in July 1961. The females bite men viciously during daytime in the shade. The adults of both sexes were also found in crab-holes.

**SYSTEMATICS.** Externally, this species shows some resemblance to *Aedes mamoejoensis* and *Aedes simplex* in having wholly dark abdomen, however, it differs from the former in having sixth wing

vein reaching wing margin only slightly beyond base of fork of vein 5, and from the latter in having *apn*, *ppn*, and pleuron not wholly pale yellow. The male

and female terminalia are quite distinctive from those of *Aedes mamodjoensis* and *Aedes simplex* as well as other known species.

*AEDES (FINLAYA) LOI LIEN, N. SP.*

**MALE.** *Head.* Vertex covered with white narrow scales on median area, dark narrow scales on submedian area intermixed with pale upright forked scales; white broad scales on lateral area intermixed with broad black scales; many black upright forked scales on nape; a line of broad white scales along eye margins; clypeus, antenna and palpus and proboscis entirely dark; torus dark, with white scales on inner side; antenna very plumose, apical segment a little shorter than subapical segment, the remaining segments subequal in length, their combined length about three times as long as subapical segment; palpus about as long as proboscis, the last two segments slightly swollen, with strong hairs directing downward and inward; proboscis stout on basal half, and slender and slightly curved downward on apical half; short curved setae present along underside of proboscis. *Thorax.* Mesonotum covered with creamy white narrow scales and dark brown narrow scales; those on anterior border creamy white and a little broader than the scales on remaining area; those on median longitudinal area and lateral longitudinal area on anterior half of mesonotum dark brown; those between these two areas creamy white; the submedian creamy white area forked on posterior half, as a narrow line directing straight toward posterior and a narrow line directing laterally toward wing-base connecting a

creamy white patch in front of wing base; the median longitudinal dark brown area connected with a short creamy white stripe which is forked at prescutellar bare space; those on the remaining area dark brown; scutellum with narrow pale scales on all lobes; some dark narrow scales also present on mid-lobe; *apn* with white broad scales; *ppn* largely covered with white broad scales; paratergite bare; white broad scales present on postspiracular area, pre-alar knob just below bristles, propleuron, upper part of sternopleuron, posterior lower corner of sternopleuron just above mid-coxa, upper part of mesepimeron and an area just below it; a white broad scale present on subspiracular area; pale broad scales also present on extreme base of all coxae in front; all trochanters with pale scales. Fore-leg with femur dark except for a narrow pale area at base and a pale area at apex on underside; tibia entirely dark; tarsus dark except for a narrow pale ring at base of tarsal segment I and a small indistinct pale patch on II. Mid-leg with femur dark except for a narrow pale ring at apex and a narrow stripe running from base nearly to apex on posteroventral aspect; tibia entirely dark, tarsus dark except for a narrow basal ring at tarsal segment I, a small pale patch on II and III. Hind-leg with femur pale on basal half, dark on apical half both anteriorly and posteriorly, dorsal aspect of basal half narrowly dark,

a narrow pale ring also present at apex, tarsus dark except for a pale basal ring on tarsal segment I and a small pale patch at base of II. Wings dark scaled; alula with dark scales along its margin; squama fringed with brown bristles; haltere knob dark, with some pale scales at apex.

*Abdomen.* Dark above except for a basal pale band on tergite VIII; tergites with lateral white patches; sternites with basal white bands. *Terminalia* (Fig. 1, h-1). Sidepiece elongate, with a patch of slender hairs on basal tergomesal lobe; clasper slender, tapering and slightly curved near tip, about one-half as long as sidepiece, with a simple spiniform; the claw about one-third of the clasper; claspette with stem rather stout, swollen subapically, a stout bristle on swollen part, a long stout bristle near base, a stout bristle and a slender bristle near apex and a broad horn-like filament at apex; phallosome simple, with no teeth or serration; ninth tergite with 3-4 stout bristles on each lobe, ninth sternites with two bristles.

**FEMALE.** Agreeing with male in general coloration. Dark scales on dorsum of vertex only a little more numerous than in male. Antennal flagellar segments more or less subequal in length, with sparse short flagellar bristles and numerous pubescence. Palpus about one-fifth as long as proboscis; apical half of proboscis not very distinctly more slender than basal half. Mesonotal scaling very similar to that of male, only differing in having a narrow dark line dividing the submedian creamy white area on anterior half of mesonotum; subspiracular area with a linear patch of about four broad

white scales. Mid-tarsal segment III with no pale patch at base; hind-tarsal segment II with a basal pale ring instead of a small basal patch.

**PUPA** (as Fig. 4, g, h).

**LARVA** (Fig. 4, a-f). *Head.* Antenna rather short, about 8.5 times the greatest width; shaft smooth, slightly darkened; hair 1-A 2-branched, inserted at about basal three-fifths (0.63); hair 1-C single, slender; 7-C with 2-3 branches; 6-C with 2 branches, far anterior to the level of base of antenna; 4-C small, close to 6-C, with 2 branches; 5-C far posterior to the level of base of antenna, single, slightly longer than antenna; 8, 10-C slender, single; 9-C bifid; 11-C bifid; 12-15-C single; mentum with 19 teeth; median hairs of mouth brush pectinate. *Thorax.* Prothoracic hairs 1-3-P arising from a sclerotized plate; 1-P short, with two branches; 2-P single; 3-P single, plumose; 4-P single; 5-7-P all single, plumose, subequal in length; 8-P short, with two branches. *Abdomen.* Segment VIII with comb of 27-28 apically fringed scale-like teeth in a triangular patch; hair 1-VIII 2-3-branched; 2,4-VIII both single; 3-VIII with four plumose long branches; 5-VIII 2-3-branched; anal segment sclerotized dorsally, the sclerotized part occupying more than one-half of the segment; hair 1-X single; [posterior edge above 1-X with strong spicules; 2-X with three long branches; 3-X single, longer than 2-X; 4-X consisting of eight long 2-branched hairs on barred area, and in addition to those eight hairs, there are two smaller hairs, arising from membrane toward base of segment; anal gills about 1.5 times the length of anal

segment. Siphon with acus; index about 2.2 in compressed specimen. Pecten of 13-16 teeth, each with a large and some small lateral denticles; hair 1-S of three branches at about middle.

TYPE SPECIMENS. Holotype, male (61698.14) with larval and pupal skins, *ex* bamboo-stumps of *Phyllostachys pubescens*, Fengchihu, Chuchi, Chia Hsien, Taiwan, April 11, 1961 J.C. Lien and C. L. Chung; allotype, female (61698.15) with larval and pupal skins, same data as for holotype; paratypes, five males (61698.7, .10, .11, .12, .17) and ten females (61698.6, .8, .9, .13, .18-.23), with corresponding larval and pupal skins, two males (61698.1, .4) and two females (61698.2, .3) with corresponding pupal skins and a pupal skin (61698.5), same data as for holotype. The specimens are in the collection of Taiwan Provincial Malaria Research Institute, Nankang, Taipei Hsien, Taiwan.

DISTRIBUTION. Known also from Kulo of Laii, Pingtung Hsien, and Chiapaotai of Hoping, Taichung Hsien, Taiwan.

#### *Aedes* (FINLAYA) CHUNGI LIEN, N. SP.

MALE. *Head*. Vertex entirely covered with broad white scales dorsally and laterally, except for a few broad dark scales submedially toward front and some upright forked pale scales posteriorly; clypeus, antenna, palpus and proboscis black; antenna very plumose, apical flagellar segment slightly shorter than subapical flagellar segment, the combined length of remaining flagellar segments about twice the length of subapical segment; palpus shorter than proboscis by the length of subapical segment; tip of

SYSTEMATICS. This species falls in the subgroup XI (*fengi*) in group F (*alboannulatus*-group: *Danielsia*) according to Knight and Marks (1952). It differs from *Aedes fengi* Edwards, 1935 very slightly in adult stage but remarkably in larval stage. *Aedes fengi* has three rather narrow stripes of creamy-white scales on anterior half of mesonotum, while this species has only two fairly broad stripes of creamy-white scales. The male terminalia of this species, when compared with Edwards' (1935) description of *Aedes fengi*, shows a close resemblance. According to Li and Wu (1935) the larva of *Aedes fengi* has 13-17 irregularly arranged comb teeth, each of which has a sharp termination and lateral fringe. The larva of this species has 27-28 apically fringed scale-like teeth in a triangular patch.

REMARKS. This species is named after Mr. Teng Shou Lo who collected this mosquito for the first time in 1954 from Kulo of Laii, Pingtung Hsien, Taiwan.

the long segment and the last two segments with some bristles directing inward and downward; proboscis stout on basal half, slender and slightly curved downward on apical half; short curved setae present along ventral side of proboscis, those of apical half more conspicuous; labium with short slender hairs. *Thorax*. Integument very black; mesonotum largely covered with fairly large narrow elongate creamy-white scales having greenish tinge; some dark narrow scales on area a little above and before scutal angle on each

side; scutellum with some pale broad scales on all three lobes; *apn* with white broad scales; *ppn* largely covered with white broad scales and some pale narrower scales along dorsal border; a patch of white broad scales present on paratergite, propleuron, pre-alar knob below bristles, upper part of sternopleuron, posterior corner of sternopleuron just above mid-coxa, a broad longitudinal area on upper and lower mesepimeron and a small area on extreme base of fore- and mid-coxae; two similar scales present on subspiracular area; legs black with white markings; trochanters with pale scales; fore-femur with pale scales forming an indistinct line toward apical half posteriorly; fore-tibia with an indistinct pale streak and a pale apical patch on posterior aspect; fore-tarsus entirely dark; posterior aspect of mid-femur entirely pale except for a small dark area dorsally on apical half; anterior aspect of mid-femur narrowly pale ventrally from base to tip except for a small dark area subapically; mid-tibia and tarsus entirely dark except for a pale area at apex of tibia and base of tarsal segment I on anterior aspect; hind-femur entirely pale both anteriorly and posteriorly except for a dark narrow area at base, and a broad dark band subapically; the dark band broader on dorsal aspect; hind-tibia and tarsus entirely dark except for a pale ring at base of tarsal segment I; wings darkscaled; alula with dark narrow scales along its margin; squama fringed with slender bristles; some pale yellow scales at base of wing-costa; haltere-knob dark, with pale scales at tip. *Abdomen*. Tergites dark, with basal lateral white patches on segments

I-VIII, the lateral patches on IV-VI produced onto dorsum forming narrow incomplete basal bands; sternites dark, with basal pale bands on III-VIII; dark scales on sternites IV-VII more or less roughened and erect. *Terminalia* (Fig. 2, a-e). Sidepiece elongate with small basal tergomesal lobe bearing a dense collection of long slender bristles; similar bristles also present subapically on inner ventral border; clasper comparatively short, with minute spicules, and a slender spiniform on apex; spiniform about one-third of clasper; filament of claspette very slightly expanded in middle, much longer than stem; phallosome strongly sclerotized, concave at apex, with no teeth or serration; ninth sternite with two bristles near apex medially; ninth tergite with 4-5 bristles on each lobe.

**FEMALE.** Agreeing with male in general coloration. Vertex mainly covered with broad flat scales, some upright dark scales present on dorsum and pale narrow curved scales on nape intermixed with upright forked pale scales; scales on median and lateral areas and eye margins white; scales on submedian area and a small area posterior to lateral white area dark. Antennal flagellar segments subequal in length, with sparse flagellar bristles and dense pubescence. Apical half of proboscis not distinctly more slender than basal half; palpus about one-fourth the length of proboscis. Eighth abdominal tergite and sternite entirely dark; lateral white patches on abdominal tergites not produced onto dorsum; sternite II also with a basal white band. Pale scaling on fore- and mid-femur less extensive than that of male; apex of mid-tibia not pale apically;



fore-tibia and tarsal segment I with an indistinct pale streak on posterior aspect.

PUPA (as Fig. 5, g, h).

LARVA (Fig. 5, a-f). *Head*. Antenna rather short, about 8.4 times the length of the greatest width; shaft smooth, slightly darkened; hair 1-A inserted slightly beyond middle, single; head hair 1-C very stout, slightly curved inward; 7-C 3-branched; 6-C single, about the length of antenna, at about level of base of antenna; 4-C very small, close to 6-C, 5-6-branched; 5-C far behind 6-C, single; 8, 10-C fine, single; 9-C bifid; 11-C 6-branched; 12-C trifid; 13, 14-C both single; 15-C bifid; median hairs of mouth brush strongly pectinate; mentum with 21 teeth. *Thorax*. Prothoracic hairs 1-3-P arising from a small weakly sclerotized plate; 1-P 3-branched; 2-P single; 3-P with two long branches; 4-P 2-branched; 5, 6-P both single, sparsely plumose; 7-P with two plumose branches; 8-P 5-branched. *Abdomen*. Segment VIII with comb of 32-33 elongate teeth in a triangular patch, each tooth sharply pointed and fringed laterally, the fringe near apex stronger than that near base; 1-VIII 3-4-branched; 2,4-VIII both single; 3-VIII with 5-6 plumose long branches; 5-VIII with 3-4 plumose branches; anal segment nearly completely ringed, only leaving a narrow ventral area not sclerotized; hair 1-X 1-2-branched; posterior border above 1-X with strong spines; 2-X 3-branched; 3-X single; 4-X consisting of ten hairs, each with 2-3 branches, proximal two small hairs arising outside barred area; anal gills slender, pointed, about 1.5 times as long as anal segment. Siphon with acus,

dark brown, color lighter on about apical one-sixth; index about two in compressed specimen. Pecten of 14-15 short teeth, each tooth with a large and some small lateral denticles; hair 1-S 5-6-branched, inserted at about three-fifths (0.57) from base.

TYPE SPECIMENS. Holotype, male (62025.2) with larval and pupal skins, *ex* bamboo stumps, Fengchihu, Chuchi, Chiai Hsien, Taiwan, April 12, 1961, J. C. Lien and C. L. Chung; allotype, female (62025.3) with larval and pupal skins, same data as for holotype; paratypes, three females (62025.1, 61706.6, .7) with corresponding larval and pupal skins, same data as for holotype. The specimens are in the collection of Taiwan Provincial Malaria Research Institute, Nankang, Taipei Hsien, Taiwan.

DISTRIBUTION. Known only from type locality.

BIOLOGY. The larvae were found breeding together with *Aedes loi*, n. sp. in bamboo-stumps. The habits of adults are unknown.

SYSTEMATICS. This species falls in the subgroup V (*unicinctus*) of group B (*terrens*-group: *Gualteria*) of Knight and Marks (1952). It is very closely related to *Aedes unicinctus*, but differs from it in having pale broad scales on scutellar lobes, phallosome with no teeth or serration and in larva apically pointed comb teeth instead of scale-like comb teeth. According to Barraud's (1934) description of *Aedes unicinctus*, the scutellar scales are mostly narrow and there are some dark scales on mid-lobe, however, in this species these scales are broad and pale and there are no dark scales on mid-

lobe. The author has seen in the British Museum (Natural History) the male and female specimens labelled "*Aedes unicinctus*, W Himalayas, Krol Mt., W Solan, VIII, 1924, tree-hole, P. J. Barraud". These might be synonymous with this species, since they are quite similar to

this species in many respects, especially in the scaling of scutellar lobes.

REMARKS. This species is named after Mr. Chao Lin Chung of Taiwan Provincial Malaria Research Institute, one of the members who participated in the field collection.

*AEDES (FINLAYA) WATTENI* LIEN, N. SP.

MALE. *Head*. Vertex clothed mainly with brown flat scales, and a line of pale scales around the eyes, broadened laterally; a patch of black forked scales on nape. Tori and clypeus black; unscaled. Antenna about four-fifths of proboscis in length, plumose. Proboscis and palpus black-scaled, the latter shorter than the former by about the length of the last segment. *Thorax*. Integument black; mesonotum with anterior two-thirds clothed mainly with silvery scales, those on the lateral margins extending nearly to the level of wing-base; posterior margin of the pale-scaled area more or less straight; pale scales present around prescutellar bare space; remainder of mesonotum, and scutellum dark-scaled; *apn* with a patch of broad silvery scales; *ppn* with 3-4 broad white scales. Pleura with patches of broad pale scales in the propleural, pre-alar, upper and lower sternopleural, and mesepimeral regions. Pleural setae: Propleural seven; posterior pronotal five; post-spiracular three; upper sternopleural 5-6; posterior margin of sternopleuron with one very strong seta; lower sternopleural 2-3; pre-alar seven; upper mesepimeral three. Coxae of legs with anterior pale scaling. Femur with a longitudinal pale patch on the basal four-fifths of the ventral surface; otherwise dark; mid-femur

dark with a longitudinal stripe along the whole length of ventral surface. Hind-femur extensively pale on all aspects of basal four-fifths. Tibiae and tarsi all dark. Tarsal claws of fore- and mid-legs unequal, larger one toothed; those of hind-leg equal and simple. Wing dark-scaled; fork of vein 2 about level with that of vein 4. Halteres black-scaled. *Abdomen*. Mainly dark-scaled; tergites all with prominent laterobasal spots, those on VII produced medially to form a basal band. Sternites II-VII with broad basal pale bands. *Terminalia* (Fig. 2, 1-p). Sidepiece about two times as long as broad; basal tergomesal area with a group of hairs; basal ridge with a line of rather fine setae extending to its apex, the most apical two not curved; dorsal basal area with slender setae; ninth tergite with 2-3 stout, dark lanceolate setae on each lobe; claspette filament narrow, apical portion fine and curved; phallosome with fimbriate apical border.

FEMALE. Differing from male as follows: Antenna much less plumose; palpus about one-seventh of proboscis in length; a line of pale scales around the eyes broadened medially; the silvery scaling of mesonotum on anterior third indented posteriorly, anterior margin not separated by a dark scaling; tergites V-VIII with

narrow basal pale bands.

PUPA (as Fig. 6, g, h).

LARVA (Fig. 6, a-f). *Head*. Antenna with spicules, extending almost to apex on the external surface; hair 1-A plumose, with 10-11 branches; head hair 1-C long, slender, slightly curved inward; 3-C single; 4-C 13-branched; 5-C 9-branched; 6-C 11-13-branched; 7-C 9-11-branched; 8-C 6-branched; 10-C trifid; 11-C 10-14-branched; 12-C 5-branched; 13-C single; 14-C stout, 3-branched; 15-C stout, 2-3-branched; median hairs of mouth brush with strong, weak or no serration; mentum with 9-10 teeth on each side of the large central one. *Thorax and Abdomen*. Integument glabrous; development of stellate hair tufts very weak. Segment VIII with ten sharply pointed comb teeth in a row, each tooth with fine basal fringe, restricted to the periphery of the basal attachment, dorsal two teeth with coarser fringe near tip of basal attachment; hair 1-VIII weakly plumose, 5-6-branched; 3-VIII strongly plumose, 7-branched; 5-VIII weakly plumose, 7-branched; 2, 4-VIII both single. Siphon with acus roughly ovoid, detached; index 2.5 in compressed specimen; siphon-saddle ratio 2.5; hair 1-S 4-5-branched; pecten with 15-19 slender teeth, each with 1-2 denticles. Saddle with some short spines on posterior border; hair 1-X bifid; 2-X 3-branched; 3-X single; 4-X consisting of eight hairs, each with 3-4 branches; anal gills about the length of saddle, ventral pair slightly shorter than dorsal pair.

TYPE SPECIMENS. Holotype, male (78562.2) with larval and pupal skins, *ex* tree-hole, coastal forest, Chuanfanshih,

Wolan, Hengchung, Pingtung Hsien, Taiwan, July 20, 1963, J. C. Lien, S. Y. Lin, P. S. Chen and M. L. Liu; allotype, female (78562.9) with larval and pupal skins, same data as for holotype; paratypes, ten males (78562.3, .4, .5, .6, .7, .8, .12, .14, .18, .19) and nine females (78562.1, .10, .11, .13, .15, .16, .17, .20, .21) with corresponding larval and pupal skins, same data as for holotype. The specimens are in the collection of Taiwan Provincial Malaria Research Institute, Nankang, Taipei Hsien, Taiwan.

DISTRIBUTION. Known only from type locality.

BIOLOGY. The larva breeds in tree-holes together with *Aedes albopictus*, *Aedes scutellaris scutellaris*, *Culex brevipalpis* and *Armigeres subalbatus*. The habits of adults are unknown.

SYSTEMATICS. This species falls in the subgroup I (*niveus*) of group H (*geniculatus*-group: *Protomacleaya*) of Knight and Marks (1952). The female of this species, when compared with the descriptions of this subgroup of Colless (1958, 1959), is very similar to *Aedes novoniveus*, however, the fourth instar larva shows a close resemblance to *Aedes albolateralis*. The male terminalia of this species is very distinctive, differing from *Aedes albolateralis* (Fig. 2, g-k) in that there are no prominent tuft of pointed scales of several lengths on dorsal basal area. This species also shows a close resemblance to '*A. niveus*' of Feng (1938) in that there is a group of hairs on basal tergo-mesal area, however, differs from it in having some long setae on dorsal basal area of sidepiece which are lacking in '*A. niveus*' of Feng. Colless (1958) states

that '*A. niveus*' of Feng probably belongs to *A. sinensis* Chow, however, the author is inclined to believe that they are separate species, since *A. sinensis* has no group of hairs on basal tergomesal area. According to Chow's description *A. sinensis* is characterized by having *ppn* with a patch of broad white scales, basally dorsal inner surface (basal tergomesal area) and lateral margin (dorsal basal area) of sidepiece bare and larval mouth brush hairs simple. *A. sinensis* was described from the specimens obtained from central part of Taiwan. Despite careful examination of a large number of the specimens of this subgroup the author obtained from various localities in Taiwan including those from the type localities of *A. sinensis*, he was not able to find a single specimen that could be attributed to *A. sinensis*. *Aedes albolateralis* (Fig. 2, g-k) is very widely distributed in Taiwan Proper and most commonly encountered

in foothill regions. According to published papers, broad pale scales are absent on *ppn* of *A. albolateralis*. However, in the Taiwan specimens of *A. albolateralis* this character does not hold true. The number of broad pale scales on *ppn* in *A. albolateralis* of Taiwan varies from none to around ten. The proportion of those having no pale scales on *ppn* is indeed much greater than those having pale scales on *ppn* in the population of *A. albolateralis* of Taiwan. The author's observation revealed that the females of *A. albolateralis* with pale scales on *ppn* also produced the progenies with no pale scales; the result was reversed with the females having no pale scales.

REMARKS. This species is named in honor of Capt. R. H. Watten, Commanding Officer, U. S. Naval Medical Research Unit No. 2, who kindly encouraged and rendered strong support to the project.

*AEDES (FINLAYA) OMORII* LIEN, N. SP.

MALE. *Head*. Vertex clothed mainly with flat dark scales, and a line of pale scales around the eyes, broadened laterally; a patch of black forked scales on the nape. Tori and clypeus black, unscaled. Antenna about four-fifths of proboscis in length, plumose; proboscis and palpus black-scaled, the latter shorter than the former by about the length of the last segment. *Thorax*. Integument black; mesonotum with anterior two-thirds clothed mainly with silvery scales, those on the lateral margins extending nearly to the level of wing-base; posterior margin of the pale-scaled area more or less straight; a few pale scales present around pre-

scutellar bare space; remainder of mesonotum, and scutellum dark-scaled; *apn* with a patch of broad silvery scales; *ppn* with no scales; pleura with patches of broad pale scales in the propleural, pre-alar, upper and lower sternopleural, and mesepimeral regions. Pleural seta: Propleural six; posterior pronotal 4-5; postspiracular three; upper sternopleural three; posterior margin of sternopleuron with one very strong seta, lower sternopleural 2-5; pre-alar 6-7; upper mesepimeral 7-8. Coxae of legs with anterior pale scaling, lateral scaling present only on hind-coxa. Fore-femur with a longitudinal pale patch on the basal half of the ventral surface;

otherwise dark. Mid-femur dark with a longitudinal stripe along the ventral surface. Hind-femur extensively pale on the ventral surface of basal half, less extensively pale on the venter of apical half. Tibiae and tarsi all dark; tarsal claws of fore and mid-legs unequal, longer one toothed; those of hind-legs equal and simple. Wings dark-scaled; fork of vein 2 about level with that of vein 4. Halteres black-scaled. *Abdomen*. Mainly dark-scaled; tergites all with prominent latero-basal spots, those on tergite VII produced medially to form a basal band; sternites II-VII with broad basal pale bands. *Terminalia* (Fig. 2, q-v). Sidepiece about two times as long as broad; dorsal basal area with long hairs of normal type only; basal ridge dark, somewhat triangular in shape, with a line of six long stout setae; ninth tergite with very small lobes, each with 2-4 setae; ninth sternite with two setae; claspette filament with a large median expansion, almost clear in texture, the apical portion fine and pointed at tip; apex of phallosome with a large curved and two small straight teeth.

**FEMALE.** Differing from male as follows: Antenna much less plumose; palpus about one-seventh of proboscis in length; a line of pale scales around the eyes broadened medially; mesonotum pale anteriorly only on the lateral thirds, forming two semicircular areas completely separated by a broad dark band; lateral margins above the paratergite dark-scaled.

**PUPA** (as Fig. 7, g, h).

**LARVA** (Fig. 7, a-f). *Head*. Antenna with strong spicules, extending almost to the apex on the external surface; hair 1-A weakly plumose, with 11-12 branches;

head hair 1-C long, rather coarse, curved inward, with furcation at tip; 4-C 17-20-branched; 8-C bifid or trifid; 9-C 7-10-branched; 10-C 3-branched; 11-C 20-branched; 12-C 4-5-branched; 13-C single; 14-C stout, 8-branched; 15-C 4-5-branched; median hairs of mouth brush with strong or weak serration; mentum with ten sharp teeth on each side of the large central tooth. *Thorax and Abdomen*. Integument of thorax and abdomen conspicuously clothed with fine spicules; development of stellate hair tufts moderate. Abdominal segment VIII with ten sharply pointed comb teeth in a row, their basal half strongly fringed; hair 1-VIII with 5-6 plumose long branches; 3-VIII with 7-8 plumose long branches; 5-VIII with 6-7 plumose long branches; 2, 4-VIII both single. Siphon with acus roughly ovoid, detached; index 2.9 in compressed specimen; siphon-saddle ratio 2.75; hair 1-S 7-8-branched. Pecten with 16-20 slender teeth, each with a denticle near the centre. Saddle with posterior fringe of about 13 very strong spines, extending down to ventral margin; hair 1-X 4-branched; 2-X bifid; 3-X single; 4-X consisting of eight hairs, each with 2-5 branches; anal gills about twice as long as anal segment; ventral pair shorter than dorsal pair.

**TYPE SPECIMENS.** Holotype, male (62561.2) with larval and pupal skins, *ex* bamboo-stump, Chungmin, Yuchin, Nantou Hsien, Taiwan, August 22, 1963, C. L. Chung; allotype, female (62561.3) with larval and pupal skins, same data as for holotype; paratypes, for males (62561.1, .4, .7, .10) and four females (62561.5, .6, .8, .9) with corresponding

larval and pupal skins, same data as for holotype. The specimens are in the collection of Taiwan Provincial Malaria Research Institute, Nankang, Taipei Hsien, Taiwan.

**DISTRIBUTION.** Known only from type locality.

**BIOLOGY.** The larva breeds in bamboo stumps. The habits of adults are unknown.

**SYSTEMATICS.** This species falls in the subgroup I (*niveus*) of group H (*geniculatus*-group : *Protomacleaya*) of Knight and Marks (1952). Externally, this species shows a close resemblance to *Aedes inermis* in that the silvery scaling of the female mesonotum is reduced to small lateral areas, and separated by a broad band of dark scaling which covers about the central third of the mesonotum and extends right to the anterior margin, and to *Aedes pexus* in that the larval integument of thorax and abdomen are thickly clothed with fine spicules.

**REMARKS.** This species is named in

honor of Prof. Nanzaburo Omori of the Department of Medical Zoology, School of Medicine, Nagasaki University, who has kindly encouraged and directed the author's interest in mosquitoes.

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## 台湾産蚊族の新種(双翅目:蚊科)

### 第三報 *Aedes* 属の五新種

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#### 摘

#### 要

本編では *Aedes* 属の五新種の成熟幼虫、蛹及び雌雄成虫に就いて記載を行なった。これらはそれぞれ *Aedes* (*Cancraedes*) *penguensis*, n. sp., *Aedes* (*Finlaya*) *loi*, n. sp., *Aedes* (*Finlaya*) *chungi*, n. sp., *Aedes* (*Finlaya*) *watteni*, n. sp. 及び *Aedes* (*Finlaya*) *omorii*, n. sp. と命名された。第一種は台湾海峡にある澎湖島で、他の四種は台湾本島で採集された。*Finlaya* 亜属に属する四種の中の二種は *Aedes niveus* 亜群のものに属する。

*Aedes penguensis*, n. sp. は成虫の腹部が全部暗色である点で *A. mamodjoensis* と *A. simplex* とに近似するが、翅の第六脈は第五脈の分叉点を稍越えた部位の後縁で終っている点で後二者と異なる。又 *apn*, *ppn* と胸側は全部黄白色を呈しない点で更に *A. simplex* と異なる。雄の外部生殖器は後二者のとは全く異なる。

*Aedes loi*, n. sp. は *A. fengi* に近似し、後者とは次の様な相違点がある。1) 成虫の中胸背板前半に乳白色の鱗片より成る巾の広い二条の縦紋がある、後者では巾の狭い三条の縦紋がある。2) 成熟幼虫は先端に縁飾がある鱗状側鱗27~28枚を有する、後者は先端尖り、両側に縁飾がある刺状側鱗13~17枚を有する。

*Aedes chungi*, n. sp. は *A. unicinctus* に近似し、

後者とは次の様な相違点がある。1) 成虫の小楯板には巾の広い白色の鱗片を有する、後者は巾の狭い鱗片を有する。2) 雄陰茎には歯状物がない、後者にはこれがある。3) 側鱗は刺状、後者は鱗状である。

*Aedes watteni*, n. sp. は *Aedes niveus* 亜群に属するもので、成虫は *A. novoniveus* に近似するが、幼虫は *A. albolateralis* に近似する。雄の外部生殖器は側片の背面基部に長短不同の鱗片房を有しない点で *A. albolateralis* と異なる。又側片の basal tergomesal area に短毛群がある点で馮氏の '*A. niveus*' に近似するが、側片の背面基部には長い剛毛を有する点でこれと異なる。Colless は Feng の '*A. niveus*' は恐らく Chow の *A. sinensis* と同一種であろうと述べているが、*A. sinensis* は側片の basal tergomesal area に短毛群がない点で馮氏の '*A. niveus*' と異なる。著者は台湾の諸地方から得たこの亜群の蚊を詳細に調べた所 *A. sinensis* に帰すべきものは全然見当らなかった。台湾では *A. albolateralis* が広く分布し、山脚地帯で最も普通に採れる。

*Aedes omorii*, n. sp. も *A. niveus* 亜群に属するもので成虫は中胸背板前方三分の二にある白色部分が両側に小さく二分されている点で *A. inermis* に酷似するが、幼虫は胸部と腹部との被膜が細毛に被われている点で *A. pexus* に酷似する。

Fig. 1

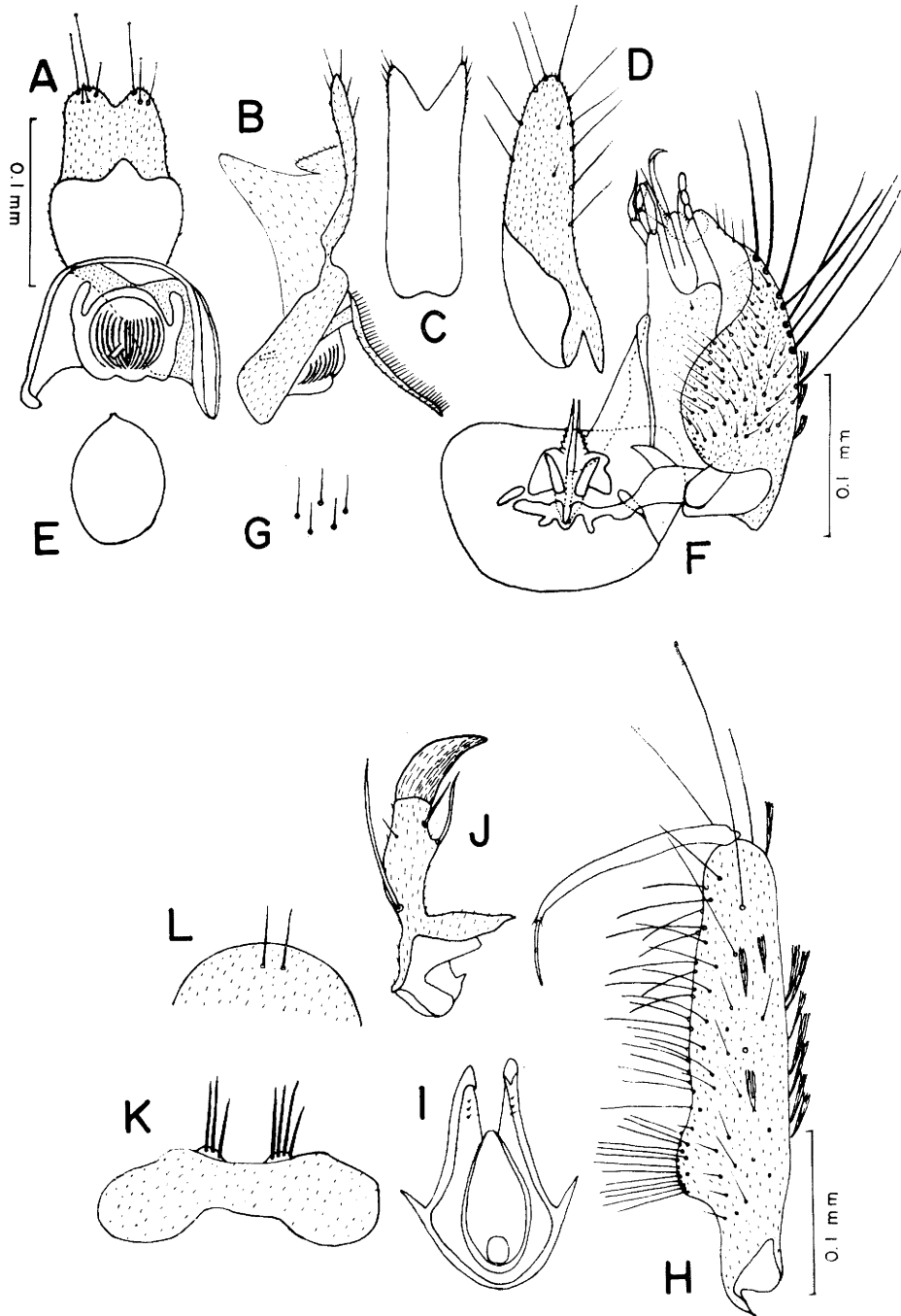


Fig. 1. A-G, *Aedes penghuensis*, n. sp.; A-E, female; F-G, male: A, postgenital plate and post-atrial plate; B, side view of postgenital plate and post-atrial plate; C, 9th tergite; D, cercus; E, spermatheca; F, terminalia; G, setae of 9th sternite; H-L, *Aedes loi*, n. sp.; H, sidepiece and clasper; I, phallosome and proctiger; J, claspette; K, 9th tergite; L, 9th sternite.



Fig. 2

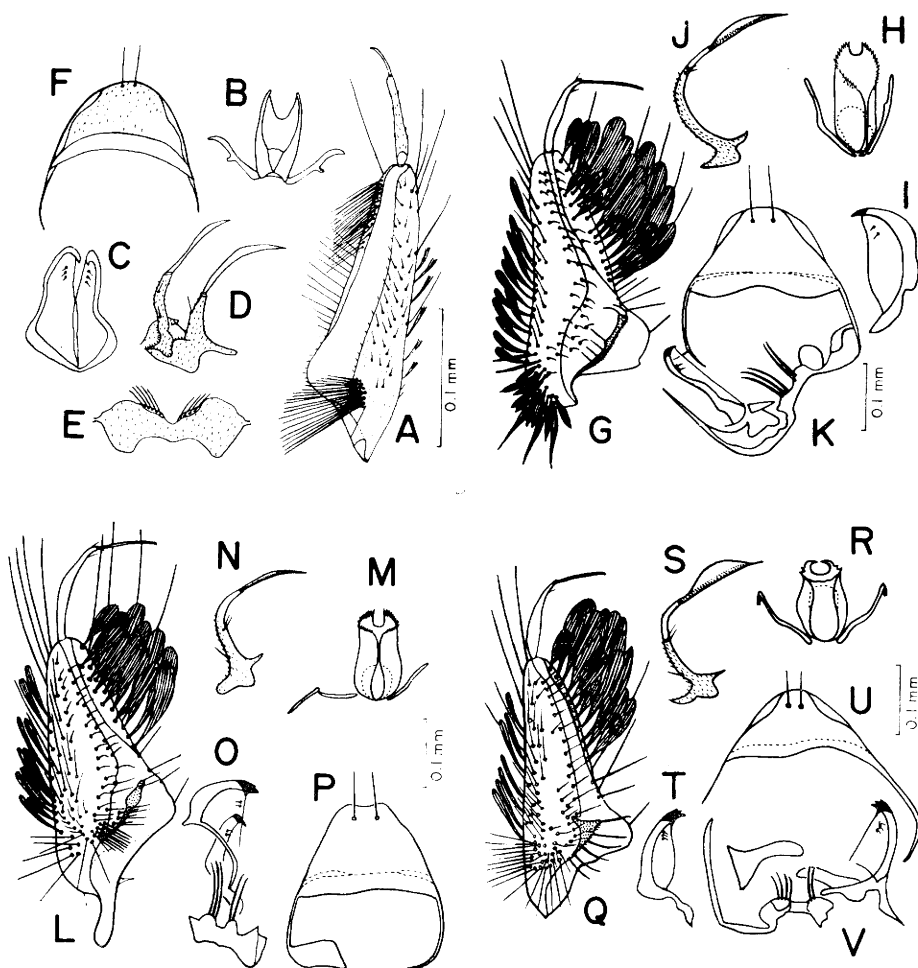


Fig. 2. A-F, *Aedes chungi*, n. sp.; A, sidepiece and clasper; B, phallosome; C, proctigers; D, claspettes; E, 9th tergite; F, 9th sternite; G-K, *Aedes albolateralis* of Chungmin, Yuchih, Nantou Hsien, Taiwan Proper; G, sidepiece and clasper; H, phallosome; I, proctiger; J, claspette; K, 9th tergite, proctiger and 9th sternite; L-P, *Aedes watteni*, n. sp.; L, sidepiece and clasper; M, Phallosome; N, claspette; O, proctiger and 9th tergite; P, 9th sternite; Q-V, *Aedes omorii*, n. sp.; Q, sidepiece and clasper; R, phallosome; S, claspette; T, proctiger; U, 9th sternite; V, 9th tergite and proctiger.

Fig. 3

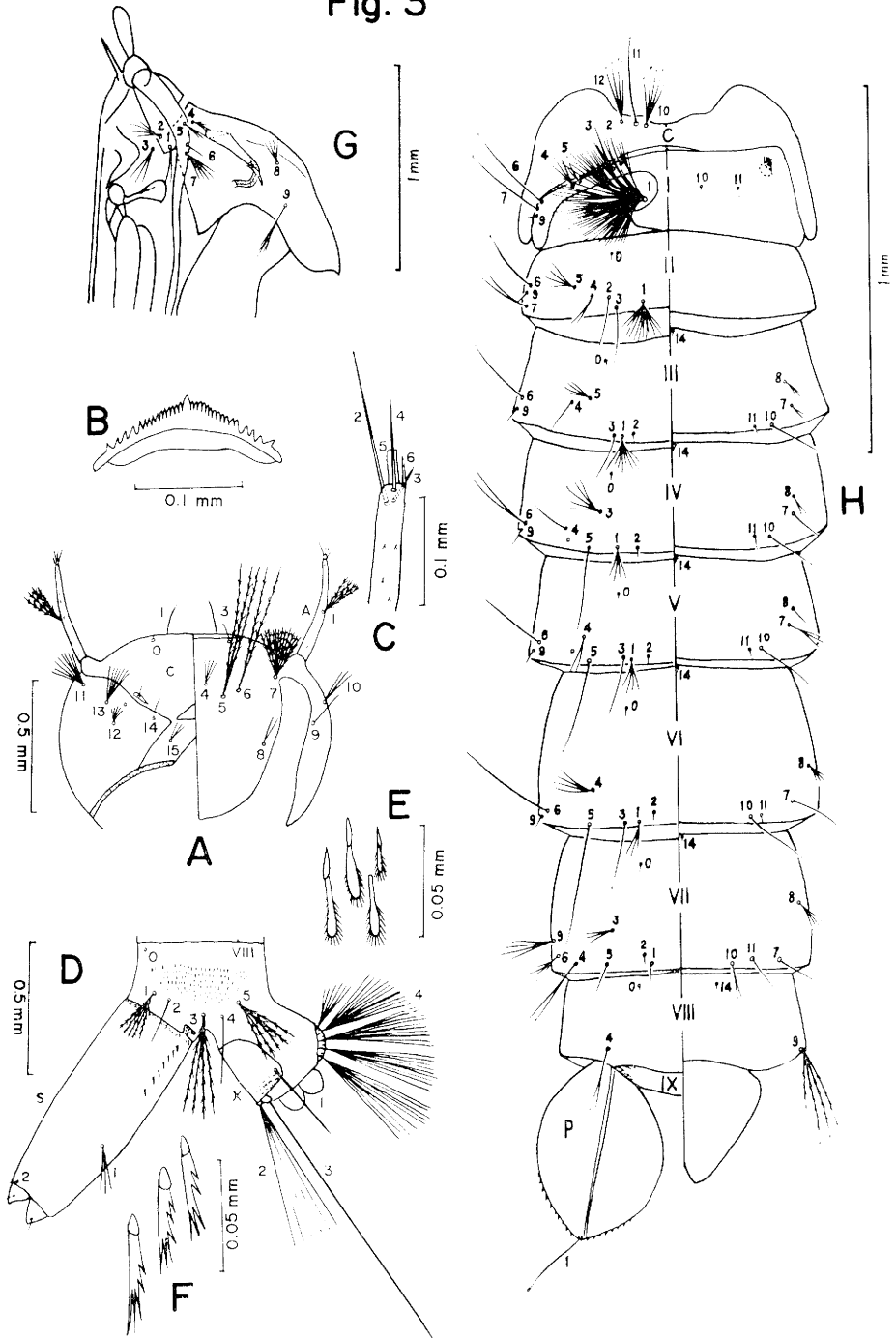


Fig. 3. *Aedes penghuensis*, n. sp.; A-F, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb teeth; F, pecten teeth; G-H, pupa; G, cephalothorax; H, metanotum and abdomen.

Fig. 4

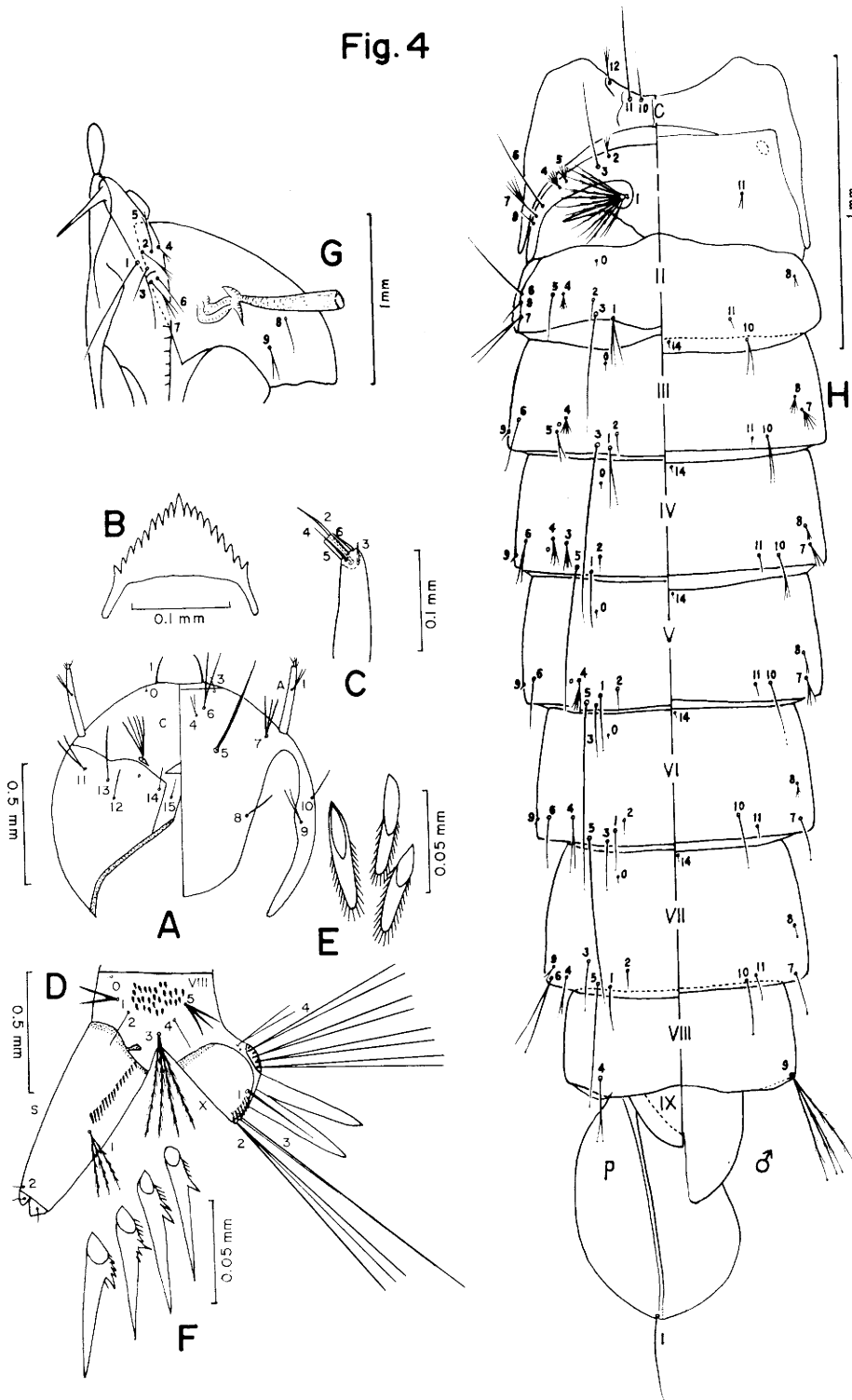


Fig. 4. *Aedes loi*, n. sp.; A-F, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb teeth; F, pecten teeth; G-H, pupa; G, cephalothorax; H, metanotum and abdomen.

Fig. 5

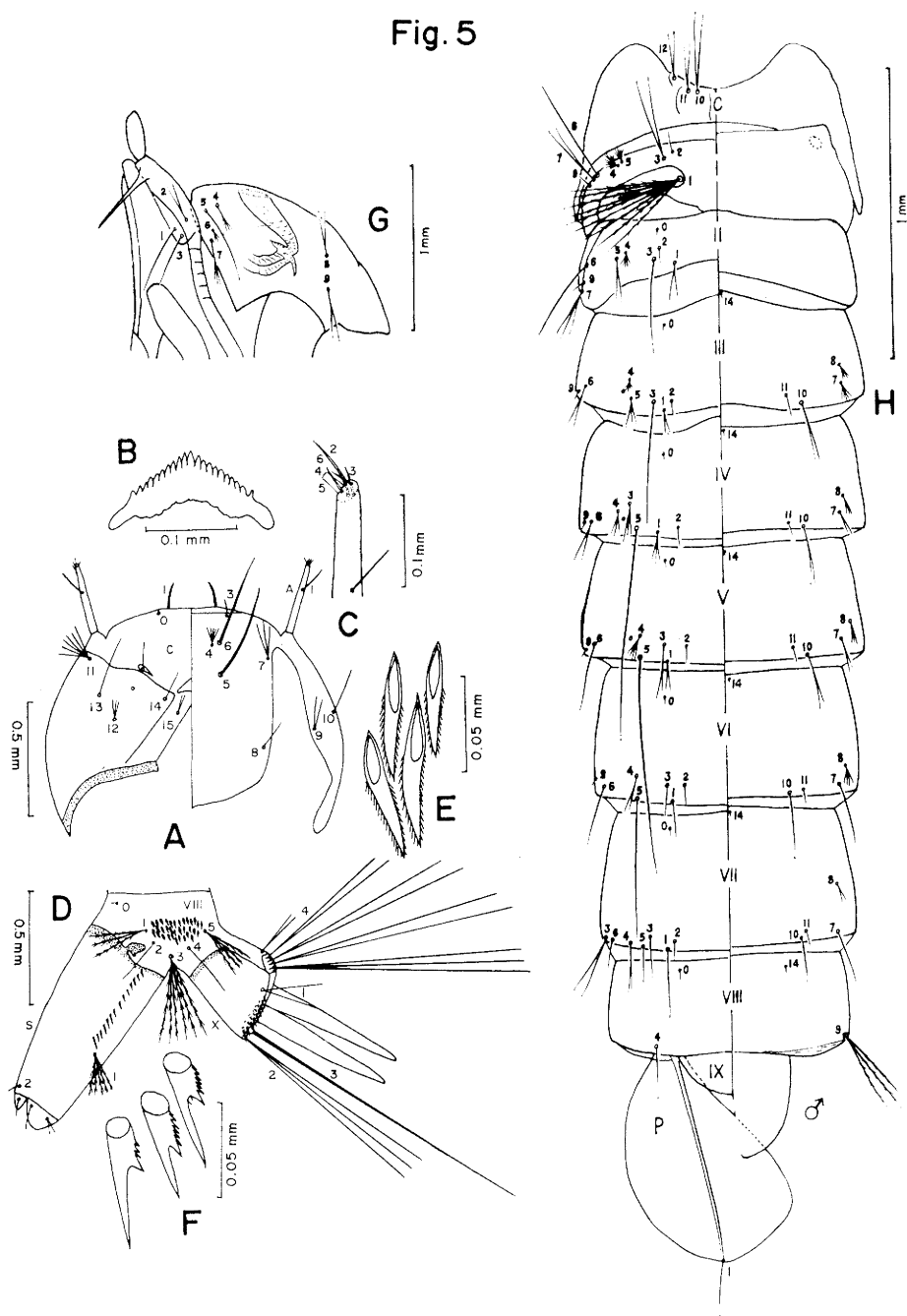


Fig. 5. *Aedes chungi*, n. sp.; A-F, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb teeth; F, pecten teeth; G-H, pupa; G, cephalothorax; H, metanotum and abdomen.

Fig. 6

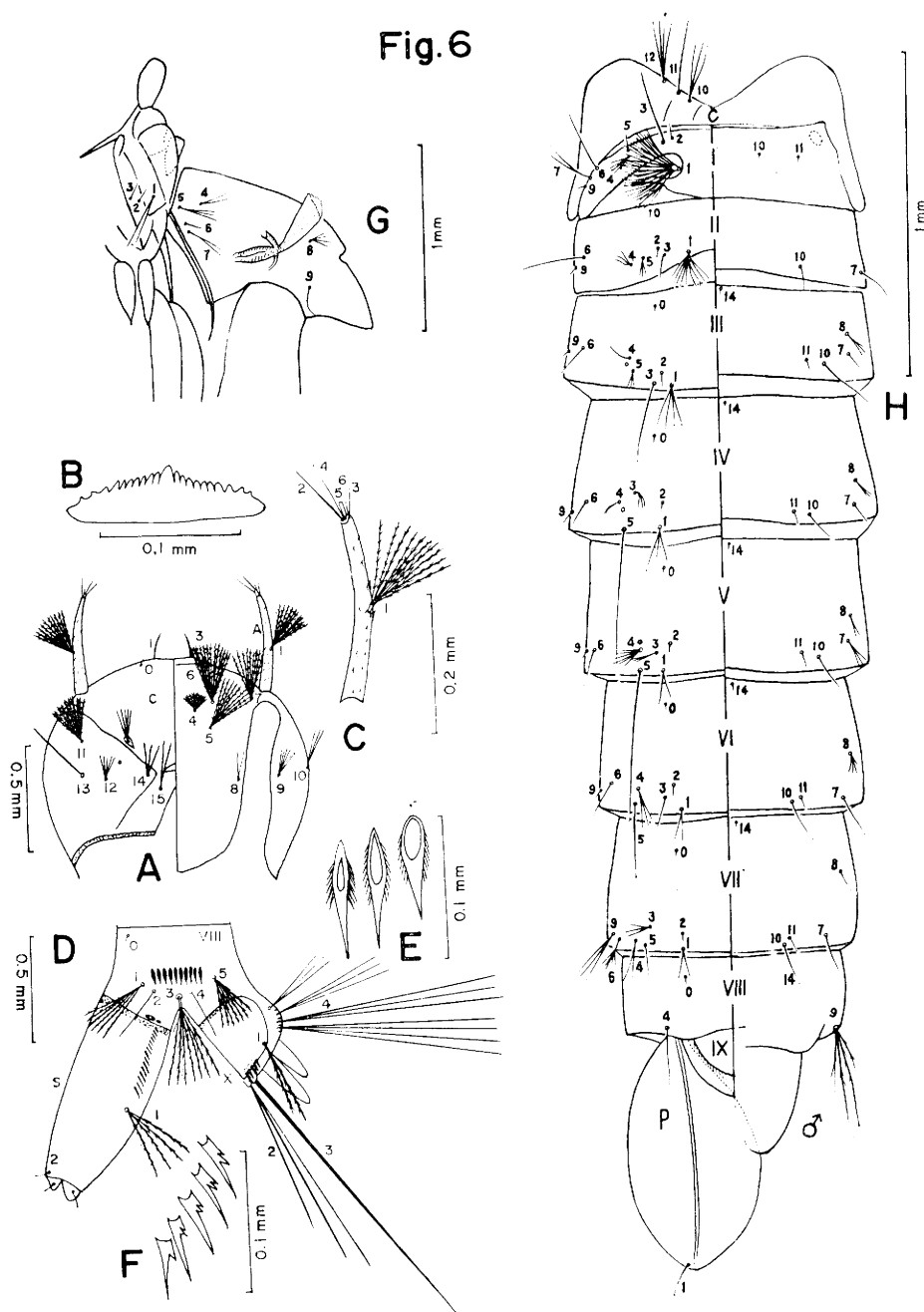


Fig. 6. *Aedes watteni*, n. sp.; A-F, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb teeth; F, pecten teeth; G-H, pupa; G, cephalothorax; H, metanotum and abdomen.

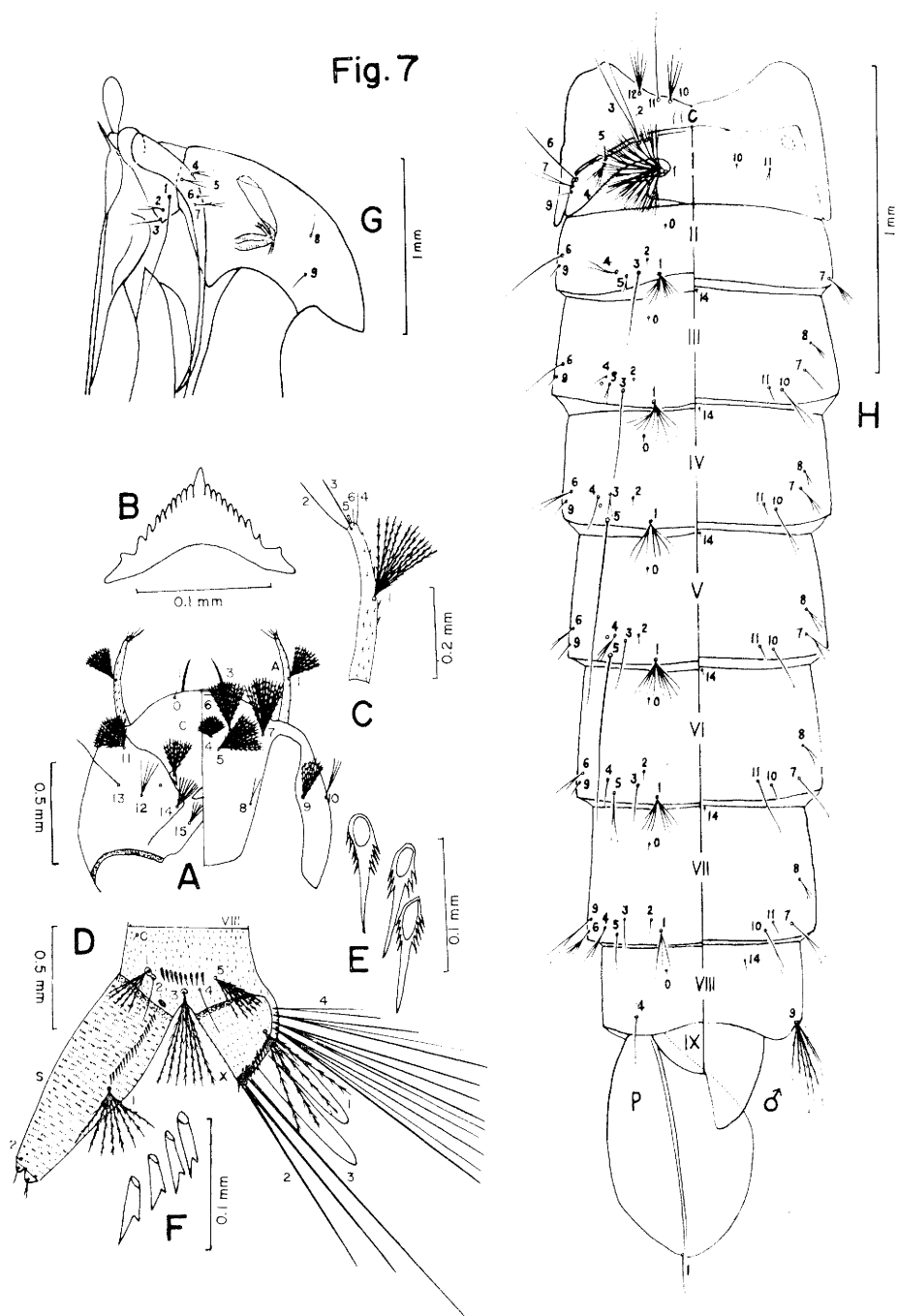


Fig. 7. *Aedes omorii*, n. sp.; A-F, larva; A, head; B, mentum; C, tip of antenna; D, terminal segments; E, comb teeth; F, pecten teeth; G-H, pupa; G, cephalothorax; H, metanotum and abdomen.